

REDESCRIPTION OF *Tarsubulura perarmata* (RATZEL, 1868) FROM A WILD-CAUGHT EASTERN TARSIER (*Tarsius* sp.)

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Abstract

Tarsubulura perarmata (Ratzel, 1868) is redescribed on the basis of specimens from the intestine of wild caught *Tarsius* sp. The specimens were compared with original description of *Subulura perarmata*, Ratzel, 1868 and the description by Brack and Niemitz, 1984. English (1958) transferred this species to *Tarsubulura perarmata* and a redescription of this taxon is presented in this paper.

Key words: *Tarsubulura perarmata*, Nematode, Tarsiers.

Introduction

The parasites of wild-caught tarsiers are not particularly well-known, relatively to many other primates that are often kept in zoos and research laboratories (Brack and Niemitz 1984). Brack and Niemitz (1984) listed twelve known endoparasites of tarsiers from previous published reports (Creplin 1846, Ratzel 1868, Porter 1952, Hill *et al.* 1952), including their own. Of these, they remarked that the nematode, *Subulura perarmata*, was relatively common, but the original description by Ratzel appeared to be incomplete and misleading. English (1958) created a new genus *Tarsubulura* with *Tarsubulura perarmata* as the type species and he transferred *S. perarmata* to *T. perarmata* because of its complex hexagonal mouth opening, which is surrounded by six lip lobes, a buccal cavity that is hexagonal in cross section, peripheral radial and chordal lobes that are fully cuticular and separated, while in *Subulura* the mouth opening is simply hexagonal, peripheral lobes fully muscular.

Determining the taxa of tarsiers that have thus far been surveyed for parasites is not a simple matter because the taxonomy of tarsiers is confusing. Identifying the provenance of the specimen, where possible, is critical, and simply using the name given in the original publication or trusting a secondary source can lead to errors (see Shekelle 2003). Creplin's material presumably comes from the same specimens examined by Burmeister (Burmeister 1846). Although the provenance of his specimens is ambiguous, the elongated nasal profile and the extended tail pencil in the illustrations indicate with some degree of confidence that he examined Eastern Tarsiers. The relatively short and sparse fur on the tail tuft further indicates an offshore island group, possibly Sangihe or Selayar, although this is speculative and would be rather

surprising. Brack and Niemitz (1984) stated that Ratzel (1868) examined *T. spectrum*, but substantial confusion is associated with that name and without further provenance information that identification should be treated circumspectly (see Shekelle 2003). Porter (1952) and Hill *et al.* (1952) reported that their animals originated from Davao, Mindanao, and thus can be confidently identified as *T. syrichta carbonarius*. Brack and Niemitz (1984) examined tarsiers from Sarawak, East Malaysia, on the island of Borneo, and are, therefore, *T. bancanus borneanus*.

Table 1: Summary of known endoparasites of tarsiers

Host by Species Group	Parasite	Source
<u>Eastern Tarsier</u>		
(unknown provenance, clearly Eastern)	<i>Filaria laevis</i>	Crepin 1846
(unknown provenance, questionably Eastern)	<i>Tarsubulura perarmata</i>	Ratzel 1868
<i>Tarsius</i> sp. (Gimpu, Central Sulawesi)	<i>Tarsubulura perarmata</i>	this report
<u>Western Tarsier</u>		
<i>Tarsius bancanus borneanus</i> (Sarawak, Borneo)	<i>Tarsubulura perarmata</i>	Brack and Niemitz 1984
	Spiruroids	
	Trichostrongylids	
	<i>Filaria</i> sp.	
	<i>Moniliformis moniliformis</i>	
	<i>Hymenolepis diminuta</i>	
	<i>Hymenolepis nana</i> -group	
	Spargana	
<u>Philippine Tarsiers</u>		
<i>Tarsius syrichta carbonarius</i> (Davao, Mindanao)	<i>Chilomastrix tarsii</i>	Porter 1952
	<i>Chilomastrix</i> sp.	Hill <i>et al.</i> 1952
	<i>Trichomonas foetus</i>	
<i>Tarsius syrichta carbonarius</i> (Davao, Mindanao)	<i>Trichomonas</i> sp.	
	<i>Eimeria</i> sp.	
	<i>Trichurus</i> sp.	
	<i>Enterobius</i> sp.	
	Hookworms	
	<i>Physocephalus sexalatus</i>	
	<i>Hymenolepis nana</i> -group	

Material and Methods

The specimens that was examined for this research originated from village of Gimpu, about 100 km south of Palu in Central Sulawesi. It was trapped by Stefan Merker in damp, secondary growth near an artificial water catchment to the west of the village. This tarsier is unique in that it is the only Eastern Tarsier known to be dead during capture and release in over 260 captures by Merker (personal communication) and Shekelle (2003). The deceased tarsier was transferred from the field into the

keeping of one of us (MS), and accessed into the collections of the Museum Zoologicum Bogoriense (MZB #24304). The degree of parasitic infestation of this animal greatly exceeded that of any other that we have examined thus far. Necropsy indicated fatty degeneration of the liver that would be consistent with an unhealthy animal that may have been in the process of dying before the time of capture. Six of *Tarsius* sp. consisted of two adult females and one adult male, one sub adult and two infant of frozen specimens were examined for helminth parasites infestation.

The nematodes found, were preserved in 70% alcohol, cleared in glycerine-alcohol solution, mounted temporarily in the same solution, observed under compound microscope. The specimens also observed with Scanning Electron Microscope (SEM), those were agitated with ultrasonic cleaner in cacodylate buffer for five minutes, pre fixed into 2.5% glutaraldehyde-cacodylate buffer solution for two hours, and postfixed by the following steps: (a) immersed in 2% tannic acid solution for six hours, (b) washed with the buffer for 15 minutes, (c) 'a' and 'b' repeated for a total of four times, (d) immersed into 1% OsO₄ solution for two hours, (e) washed twice with distilled water for 15 minutes. All of the prefixation processes were performed at 4⁰C. The specimens were dehydrated with a graded series of ethanol concentrations: 50%, 75%, 85%, 95%, absolute ethanol. The next step was dehydration in t-Butanol with a Freezed Dryer for 30-60 minutes. The dried specimens were removed from the chamber of Freezed Dryer and mounted on specimen stubs using double sided adhesive tape. The mounted nematodes were coated with gold to make them electrically conductive, then observed with SEM (Type JSM- 5310LV). Measurements are given in micrometers unless otherwise stated. Specimens were deposited in the Museum Zoological Bogoriense in Cibinong-Indonesia, (MZB Na368, Na369).

Results

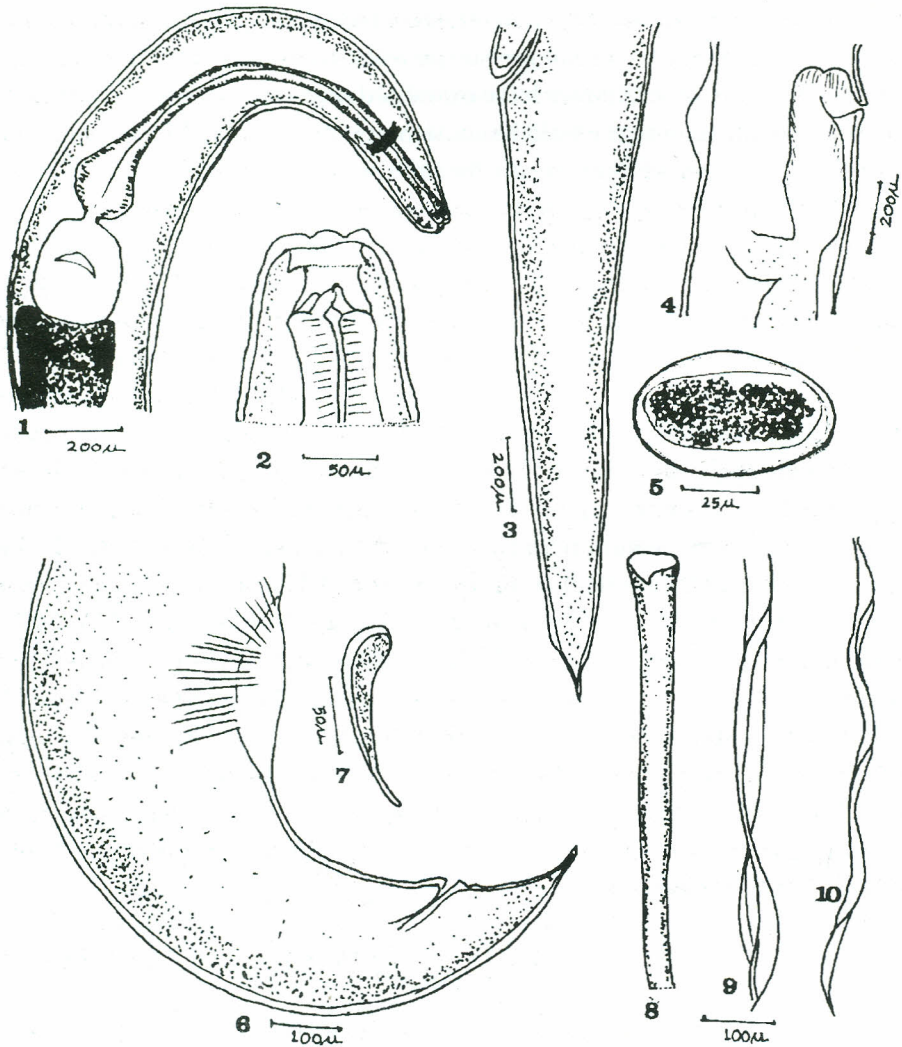
Two of the *Tarsius* sp. examined were positive with 40 and 5 nematodes respectively. The morphological characters of the nematode were close to *Tarsubulura perarmata*.

Description

Tarsubulura perarmata (Ratzel, 1868)

(Fig. 1 - 16)

General: Body filiform, cuticle transversely striated (Fig. 13), mouth with six lips and each lip with papillae (Fig. 11), buccal capsule present with three teeth at its base (Fig. 2). Cervical alae present (Fig. 12) expanding from the anterior end to the junction of esophago-intestine. Nerve ring lies at one third anterior of esophagus (Fig. 1), Excretory pore at level of esophagus. Esophagus tubular, attenuated posteriorly followed by a bulb, valvular apparatus present (Fig. 1). Tail short in both sexes, ending in a spike (Fig. 3, 6 dan 15).

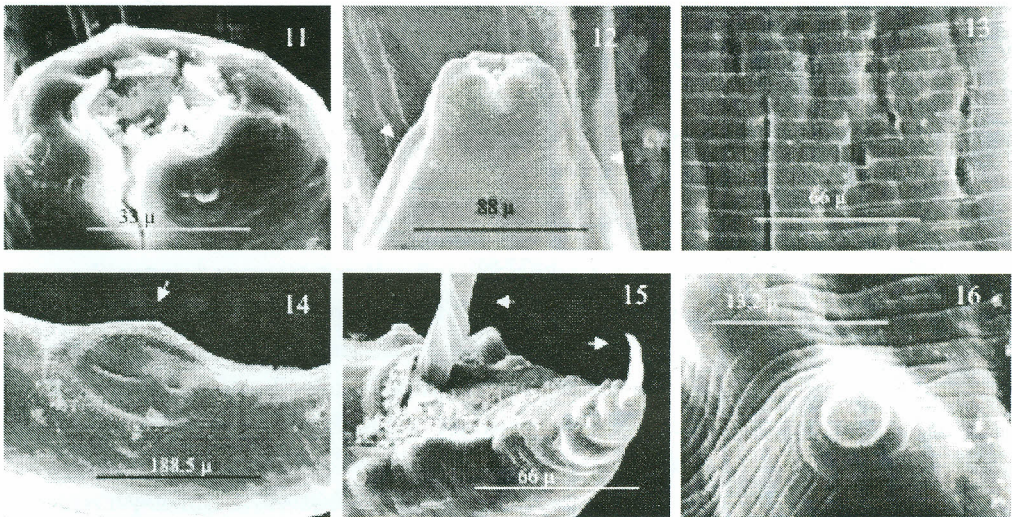


Figs. 1-10. *Tarsubulura perarmata* (Ratzel, 1868): 1. Anterior part of male, showing esophagus and the-esophago-intestinal junction; 2. Buccal capsule; 3. Posterior part of female, lateral view; 4. Vulva and vagina, lateral view; 5. Egg; 6. Posterior part of male, lateral view; 7. Gubernaculum; 8. Proximal part of spicule; 9. The beginning of twisted spicule; 10. Distal part of spicule.

Male: Length of body 13,468 width at head 62 and at midbody 363. Depth of buccal capsule 60, length 41. Nerve ring lies at 240 and excretory pore 780 from anterior end respectively, esophagus length 1768. Tail curve antero-ventrally (Fig. 6) length 217 (including spike), width 138, length of spike 64. Spicule two, similar and equal, slender (Fig. 8), become narrower distally, and twisted at two-third anterior of the length (Fig. 9, 10, 15), its total length 3857, gubernaculum small with knob at proximal end, its

length 136 (Fig. 7). Pre-anal sucker without chitinous rim, elliptical in shape (Fig. 5, 14) 246 in length , the distance of pre-anal sucker to cloaca 354. Caudal papillae sessile (Fig. 15, 16) arranging from behind the pre-anal sucker to near the spike, there are three pairs preanal , seventh pairs postanal lies in front of spike (three pairs of them smaller then others, lies near spike).

Female: Length of body 18,514, width at head 62, at midbody 460. Buccal capsule depth 64 and 46 wide. Nerve ring lies at 380, excretory pore 750 from anterior end respectively. Esophagus length 1818. Vulva in front of midbody, vagina vera length in one specimen 220, vagina uterina length 960. Uteri opposed, eggs oval, blastulated, thin shelled (Fig. 5) measure 64x48. Tail tapering ending in a spike (Fig. 3), its length 883, width 230 , spike length 76.



Figs. 11-16. *Tarsubulura perarmata* (Ratzel, 1868): 11. Head and mouth of male; 12. Anterior region with the cervical papillae; 13. Striae; 14. Pre-anal sucker; 15. Tip of the tail; 16. High magnification of caudal papillae.

Discussion

Some morphological characters of the nematode under study is closely similar with *T. perarmata* as described by Ratzel (1868) and Brack & Niemitz (1984). It was longer than those described before (Table 2). Ratzel described that the head protruded behind the cephalic cuticle, it is possibly that the head structure mentioned above is because of the presence of cervical papillae and not noticed by Ratzel. Mouth armed with three elongate, short lancet like and slightly curved structure. Esophagus length is 1/8 of the total body length, an esophageal bulb is 150 wide and its has a valvular apparatus with three semilunar teeth on it, those characters being similar with the

nematodes under study. There were three spicules, two of them are longer, crested and twisted, while another one is short and straight. It was possibly because of the mistook of the gubernaculum with a short and straight spicule. Commonly the nematod have one or two spicules (Chitwood & Chitwood, 1977).

Tabel 2. Measurements of *T. perarmata* present study, Ratzel (1868) and Brack & Niemitz, 1984.

Measurements (μ)	Present Study	Ratzel	Brack & Niemitz
Male			
Total length	13.468(12.170-4,650)	6000-7000	6000-8000
Width at: head	62(58-70)	-	-
Maximum	363(340-380)	200	200
Buccal capsule : depth	60(55-65)	-	-
Length	41(40-42)	-	-
Nerve ring *	240	-	-
Excretory pore*	780	-	-
Esophagus length	1768(1520)	750-875	-
Tail : length	217(190-230)	-	-
Width	138(130-160)	-	-
Spike	64(57-80)	-	-
Spicule length	3857(3666-4633)	-	-
Gubernaculum length	136(110-166)	-	-
Diameter of pre-cloacal sucker	246(220-270)	-	-
Distance of cloaca-pre-cloacal sucker		-	-
Female			
Total length	18.514(18.240-19.071)	8000-10.000	10.000
Width at: head	62(60-62)	-	-
Maximum	460(670-750)	300	300
Buccal capsule : depth	64(60-64)	-	-
Width	46(40-55)	-	-
Nerve ring*	380(-	-
Excretory pore*	750(670-750)	-	-
Esophagus	1818(1310-2090)	1000-1250	-
Vagina vera+)	220	-	-
Vagina uterina+)	960	-	-
Tail : length	883(830-940)	-	-
Width	230(220-230)	-	-
Spike	76(65-95)	-	-
Egg	64x48	-	-

* = from anterior end; +) = in one specimen

Brack and Niemitz (1984) described *S. perarmata* from *T. bancanus* in Borneo. The description was more complete than the original description (Table 1). They mentioned the cervical alae, and characterized the oesophagus as being 1/10 of the total length of body. Furthermore, they noted the presence of the gubernaculum, caudal papillae (8 pairs: 2 caudal, 2 postanal, 1 perianal, 2 preanal, and 1 near the sucker), and described two, equal and similar spicules. The spicule of the specimens under study was very similar with both nematodes described by Ratzel. A comparison of some morphological characters of the nematode under study and that by other authors bring us to the conclusions that the specimen under study is *T. perarmata*. We found some variation in the measurement and morphology but, this could happen because of the difference in host and locality.

According to Chabaud (1978) the genus *Tarsubulura* belongs to family Subuluridae, sub family Subulurinae.

T. perarmata is found in Sulawesi and Borneo, these nematodes are typically recovered from the cecum, less common from the colon, and rarely from the posterior part of the small intestine. The host species are *T. spectrum*, *T. bancanus* and *Tarsius* sp.

Acknowledgement

Financial support for the field work and maintaining captive tarsiers was provided by grants to MS by the Margot Marsh Foundation for Biodiversity Fund and the Gibbon Foundation. This material is based upon work supported by the National Science Foundation. Permits for trapping wild tarsiers were provided to MS by the Indonesian Department of Forestry. Housing facilities were provided by the Zoological Division of the Research Center for Biology, Indonesian Institute of Science (LIPI). Research permits were sponsored by the Center for Biodiversity and Conservation Studies and LIPI.

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